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"OPTIMIZING POSTGRADUATE LEARNING EXPERIENCES: A MULTI-DIMENSIONAL ANALYSIS OF FLIPPED LEARNING AND STUDENT SATISFACTION IN INDIAN CONTEXTS"

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Abstract
This study seeks to investigate the impact of Flipped Learning on student satisfaction among postgraduate students in higher education institutions situated in South India. In order to accomplish this goal, a straightforward sample method was utilized to enlist a maximum of 360 individuals. The study employed SPSS AMOS to conduct demographic profiling, hypothesis testing, and correlation analysis. The findings suggest significant positive associations between the pedagogical, social, and technical aspects of Flipped Learning and the overall degree of satisfaction. Several key factors have been recognized as essential in fostering student satisfaction, including pedagogical expertise, instructional clarity, a safe place to learn, collaborative learning, & information and communication technology (ICT) support. The practical implications include the importance of pedagogic training, the fostering of collaborative learning spaces, and the distribution of resources toward instructional technology infrastructure. Despite the useful knowledge it provides, the study is limited by its geographical focus and reliance on self-reported data. Further inquiries could be conducted to explore the enduring effects and embrace a diverse array of student demographics, hence enhancing the generalizability of the findings. This study contributes to the expanding corpus of scholarly literature on Flipped Learning, emphasizing its potential to enhance satisfaction with learning and academic performance within the realm of higher education.

Key terms: Flipped Learning, student satisfaction, postgraduate students, pedagogical elements, educational technology.

I Introduction
The conventional approaches to education, particularly those employed in higher education institutions, have faced significant criticism over an extended period of time due to their inherent limits in fostering student engagement and facilitating meaningful learning encounters. The standard lecture style, which has been widely used for the past three decades, has faced criticism due to its passive nature, failure to sustain student engagement, and ineffectiveness in addressing diverse learning requirements (Alberts, 2009). This is especially true when it comes to cultivating advanced cognitive abilities like application and analysis. Educators are increasingly adopting innovative instructional strategies that leverage

technological advancements to address the challenges they face. Flipped Learning (FL) is an emerging approach that is increasingly gaining traction. It aims to redefine the conventional classroom dynamic by relocating direct instruction beyond the confines of the physical classroom. Instead, FL incorporates in-person sessions to facilitate interactive learning and the practical application of educational principles (Teo et al., 2022). The utilization of FL facilitates the establishment of a learning environment that is characterized by increased dynamism and individualization, surpassing the constraints imposed by conventional lectures (Tan et al., 2017). This objective is achieved by leveraging the capabilities of digital tools. The inclusion of current technology to enhance learning outcomes is a defining characteristic of the educational landscape in the 21st century (Vibulphol et al., 2015). This paradigm change aligns with the ongoing evolution of the educational landscape. In the realm of vocational education, the utilization of Flipped Learning demonstrates particular promise due to its emphasis on the practical application of knowledge. According to Marshall and Kostka (2020), the utilization of FL allows educators to establish an atmosphere for learning that is characterized by enhanced immersion and a greater emphasis on learning through experience. This objective is achieved by the strategic redistribution of instructional time towards activities that necessitate active engagement and personalized guidance. Brock et al. (2013) argue that online learning (FL) offers a high degree of flexibility, enabling the adaptation of diverse learning paces and preferences. This flexibility fosters active engagement with the course content and facilitates chances for enhanced comprehension.

Numerous studies have demonstrated the benefits associated with the use of Flipped Learning in higher education institutions. Betihavas et al. (2015) and Lee, Park, and Davis (2022) emphasize the potential of this approach to empower students in assuming responsibility for their own learning trajectory, sustaining an active involvement with the course content, and cultivating skills in critical thinking and problem-solving. Furthermore, empirical evidence suggests that the implementation of Flipped Learning environments is linked to higher levels of student satisfaction and academic achievement in comparison to conventional instructional methods (Davies et al., 2013; Brewer et al., 2018). Nevertheless, all the potential advantages it may offer, Flipped Learning is not without of challenges. Lee et al. (2019) argue that hurdles to the successful application of the strategy may arise from concerns related to student preparedness, motivation, and fear with the procedure. Furthermore, the need for a strong technological infrastructure and ample resources could hinder the general implementation, particularly in settings with limited resources (Levy, 2010). However, with the increasing popularity of Flipped Learning as an innovative educational approach, especially in vocational contexts, it is crucial to undertake a comprehensive assessment of its effectiveness and explore different strategies that can be utilized to address potential challenges (Divjak et al., 2022; Ýldz et al., 2022). The use of flipped learning has promise for revolutionizing pedagogical practices, hence facilitating the development of more immersive and learner-centered educational settings, both within the Indian context and in other regions. This commitment can be achieved by additional inquiry and experimentation.

Flipped learning, a pedagogical approach, poses a challenge to the traditional educational system that has been prevalent in institutions for the past thirty years. Flipped learning provides a new perspective on the system. The shift from passive learning to active engagement, facilitated by digital resources, signifies a substantial departure from the conventional

instructional approach centered around lecture-based delivery. Educators seeking to enhance students' learning outcomes and address the constraints of conventional teaching approaches have warmly embraced this revolution. The utilization of the Flipped Learning approach offers a notable advantage in terms of personalizing the learning experience for students. Brock et al. (2013) state that FL enables students to progress through subjects at their preferred speed by providing online access to teaching materials before to class. FL is capable of catering to the specific learning preferences and needs of individual pupils. This adaptability not only fosters a deeper understanding of the subject matter among students, but it also empowers them to assume accountability for their own educational trajectory, thereby cultivating habits of self-control and self-guided learning (Lee, Park, & Davis, 2022). According to Marshall and Kostka (2020), educators have the potential to cultivate significant involvement and practical application of ideas by redistributing instructional time to facilitate collaborative problem-solving and interactive exercises. This intervention facilitates the enhancement of students' capacity to retain and transmit information among teachers.

Furthermore, Flipped Learning offers a viable resolution to the challenges arising from conventional lectures within the realm of vocational education. By extending theoretical knowledge beyond the classroom, FL allows for practical, hands-on activities that align with the skills-oriented nature of vocational training (Tan et al., 2017). The utilization of this experiential approach not only enhances students' capacity to acquire skills, but also facilitates their readiness for real-world applications, hence bridging the divide between knowledge and application (Fleischmann, 2021). The research findings provide more evidence supporting the efficacy of Flipped Learning in enhancing student academic achievement. A study conducted by Bhagat et al. (2016) found that learners in flipped learning environments achieved higher mathematics scores compared to those in conventional contexts. This study demonstrated that Flipped Learning has a substantial positive impact on student accomplishment. Despite the potential benefits it offers, Flipped Learning has significant challenges that must be addressed prior to its successful implementation. According to Lee et al. (2019), students may have challenges in properly engaging with pre-class materials as a result of factors related to their level of preparation, motivation, and access to technological resources. Moreover, the dependence on digital resources necessitates a robust technological framework, which may be lacking in specific educational environments, especially in situations with limited resources (Levy, 2010). In order to effectively address these challenges, it is imperative for educators and institutions to collaborate and provide adequate assistance and resources to both students and teachers (Divjak et al., 2022).In summary, Flipped Learning is a novel pedagogical approach that exhibits potential, particularly when used within the context of India. FL has the potential to revolutionize teaching and learning processes in higher education by utilizing modern technology to personalize the educational experience and promote active engagement. In order to ensure the successful implementation, it is important to thoroughly consider the challenges pertaining to student preparedness, motivation, and availability of technological resources. By means of continuous research and empirical investigation, Flipped Learning exhibits the capacity to facilitate educational encounters that are characterized by heightened engagement and a student-centric approach. Consequently, this has the ability to yield enhanced learning outcomes and more effectively prepare students for triumph in the era of digitalization.

II Review of Literature

Pedagogical aspect

According to Ha et al. (2019), flipped learning offers numerous prospects for student achievement by addressing essential cognitive requirements, including competence, autonomy, and social engagement. The pedagogical approach, which is based on the principles of self-efficacy and a positive mindset, highlights its capacity to transform conventional educational methods. Furthermore, the authors Oliveira et al. (2015) highlight the significant impact of flipped classroom education, which presents educators with the chance to modify curriculum and take on the responsibility of designing learning experiences. Educators have the ability to cultivate an atmosphere that promotes increased student engagement and improved learning outcomes by implementing learner-centered learning concepts and ideas of self-determination. The flipped classroom method, which draws upon social theories of teaching and active learning, promotes interactive learning and peer education, hence facilitating a more profound comprehension of course content (Rowais, 2014). Furthermore, Sevillano-Monje et al. (2022) emphasize the advantages of implementing flipped learning as a means to improve critical thinking, teamwork, and problem-solving abilities within authentic settings, thereby increasing educational encounters and scholastic achievements.

Despite the presence of some obstacles, such as technology limitations and student readiness concerns (Raphael et al., 2019; Sachika et al., 2019), research has demonstrated the superiority of the flipped classroom approach in comparison to conventional lecture-based instructional techniques. According to Shirley et al. (2016), the effectiveness of this approach lies in its capacity to facilitate collaborative learning and enhance students' understanding and application of intricate topics. In addition, Noor et al. (2022) provide a comprehensive explanation of the various benefits of the flipped classroom, such as heightened motivation, engaged learning, improved interactions, and improved academic achievement. In order to achieve successful implementation, it is imperative to address issues such as the time-consuming nature of preparation and the need to motivate students to actively engage using pre-class materials (Yuanyuan et al., 2022). However, the notable benefits of flipped learning, such as its capacity to enhance motivation, facilitate active learning, and cultivate meaningful relationships, establish it as a potential pedagogical strategy, especially within the framework of the ongoing worldwide pandemic.

H1: Pedagogical Knowledge positively influence overall satisfaction on Flipped learning.

H2: Clarity in teaching positively influence overall satisfaction on Flipped learning.

Social aspects

Based on the reviewed literature, flipped learning has become recognized as a complex pedagogical strategy with important socio-educational consequences. The study conducted by Santiago et al. (2022) emphasizes the numerous beneficial impacts of flipped learning in different aspects, such as interactions, content accessibility, autonomy, cooperation, problem-solving, making use of classroom time, as well as success in school. This highlights the significant capacity of flipped learning to fundamentally alter the social dynamics of education. The study conducted by Angel et al. (2019) highlights the significance of the inverted classroom in facilitating collaborative and participatory learning, cultivating teacher-student

contact, and augmenting the social dimensions of the learning process. Furthermore, the study conducted by Min et al. (2023) provides insights into the impact of subjective norm, a social influence mechanism, on students' perception of flipped courses, hence highlighting the social aspect of decision-making in the field of education. Yan et al. (2022) have examined the use of social media into flipped learning settings, highlighting its potential to augment learner engagement and foster critical thinking skills through collaborative and cooperative instructional endeavors. This highlights the need of utilizing digital platforms to enhance the extent of engagement and foster social learning experiences of superior quality. Furthermore, the idea of flipped inclusiveness is introduced by Tonia et al. (2020), wherein inclusion principles are integrated with flipped learning. This integration emphasizes the potential using flipped learning as a learner-centered strategy within lifelong learning contexts.

The research and evaluation of flipped educational environments have been a topic of interest in higher education settings. The authors Balakrishnan et al. (2023) examine the favorable consequences associated with the implementation of a 5E flipped educational setting (5EFL), which has been found to improve students' learning experiences and perceived level of competence. Nevertheless, Han et al. (2023) have highlighted hurdles such as having trouble completing tasks and personal barriers that impact student involvement. These concerns indicate the necessity for customized support systems to tackle these issues. Additionally, Deborah et al. (2023) highlights the efficacy of incorporating a flipped active learning classroom approach in enhancing student perception and academic performance, emphasising the significance of adaptability, explicit expectations, and effective communication in the development of educational curricula. Furthermore, the authors Nurul et al. (2022) suggest the implementation of scaffolding techniques in a flipped classroom setting as an approach to improve self-regulated learning and performance among students. They emphasize the significance of cultivating autonomy and metacognitive abilities within the social framework of flipped learning. In general, the literature that has been reviewed highlights the notable social aspects of flipped learning, encompassing collaborative interactions, learner agency, and inclusivity. In order to maximize learning results and create a welcoming and stimulating learning environment, educators must pay particular attention to all these socio-educational factors as they investigate and improve flipped learning techniques.

H3: Safe learning environment positively influences overall satisfaction on Flipped learning.

H4. Collaborative learning positively influences overall satisfaction on Flipped learning.

Technology aspects

The literature analysis indicates that the incorporation of technology into the flipped classroom model has become a crucial element, providing a range of advantages to educators and students. According to Mingliang et al. (2023), flipped learning technology emphasizes the student-centered approach, allowing learners to create their own learning methods and actively engage in their educational experience. The focus on student agency not only promotes the development of creativity and the transfer of knowledge, but also nurtures the acquisition of practical skills that are crucial for real-world implementation (Muller et al., 2023). In addition, the implementation of the flipped classroom model, which integrates both in-person and online learning modalities, fosters an interactive educational setting that promotes active participation and structured guidance (Noor et al., 2022). The combination of several teaching methods

utilizes cutting-edge technology to improve motivation, perception of learning, and academic performance (Huiqing et al., 2022). In addition, utilizing cutting-edge learning methods and technical resources in the flipped classroom environment maximizes the effectiveness of lectures, develops cognitive abilities, and improves students' proficiency in engineering practice, hence enhancing the overall learning experience (Olga et al., 2023).

Research investigating the preparedness and willingness of students to adopt flipped classroom learning further emphasizes the beneficial effects of incorporating technology. In a study conducted by Seethalakshmi et al. (2023), it was shown that there exists a positive association between personal and technical readiness and pedagogical readiness in novice nursing students. This finding suggests that these students possess a level of preparedness to embrace flipped learning. In a study conducted by Zhang et al. (2023), it was shown that the implementation of the flipped classroom approach resulted in greater knowledge and preparation among medical students in the field of disaster management. This study highlights the effectiveness of utilizing technology to facilitate learning in specialized areas. Furthermore, the study conducted by Leila et al. (2022) demonstrated that students' inclination to engage in flipped classroom instruction amidst the pandemic period was linked to their preparedness and perceived autonomy, irrespective of the mode of learning. This finding emphasizes the significance of technological preparedness in facilitating the transition to flipped learning. Furthermore, the study conducted by Tai et al. (2022) revealed that students who were exposed to the flipped classroom methodology exhibited superior academic performance in their respective courses, thereby confirming the efficacy of technology-mediated instruction in augmenting educational achievements.

The incorporation of technology in the context of the flipped classroom has a multitude of benefits. According to Olga et al. (2022), it allows for a substantial decrease in the amount of time spent in the classroom, while also empowering students to have more influence over their learning path. Furthermore, technology enables ongoing learning and the cultivation of self-directed learning abilities, promoting self-reliance and self-governance in the process of acquiring knowledge (Antonio et al., 2021). In addition, the incorporation of chatbots in the flipped classroom setting improves effectiveness by including students in the process of preparing for seminars at home, thereby fostering active learning and engagement (Jingming et al., 2023; Raimundo et al., 2022). In general, the use of technology into the flipped classroom framework presents prospects for individualized instruction, heightened student involvement, and enhanced educational achievements. Educators have the ability to establish dynamic and interactive learning environments that accommodate the varied requirements and preferences of contemporary learners through the utilization of sophisticated technical tools and new methodologies.

H5: ICT system positively influences overall satisfaction on Flipped learning.

H6. ICT value addition influences overall satisfaction on Flipped learning.

Overall satisfaction

Students in a variety of educational contexts who participate in flipped learning consistently report exceptionally high levels of satisfaction, according to the published research. In their study, Kim et al. (2023) emphasize the beneficial effects of flip-learning classes in beauty education. They found that barber educators experienced higher levels of learning motivation,

immersion, and satisfaction compared to other educators. In a similar vein, Maria et al. (2022) observed that nursing students who utilized virtual laboratories in flipped learning reported moderate to high levels of satisfaction. However, they did appreciate the importance of digital skills and intelligent assistants.

In addition, Chao et al. (2022) recorded a significant level of happiness among Chinese university students who engaged in English language learning using the flipped classroom approach. They attributed their contentment to the meticulously crafted teacher videos and the arrangement of the classroom. In their study, Yeonjoo et al. (2022) investigated a program for liberal arts English that utilized flipped learning. The findings demonstrated that students shown a strong inclination towards engaging in activities such as question and answer sessions and self-coaching. These activities, in turn, contributed to heightened motivation and confidence among the students. Furthermore, the study conducted by Chen et al. (2022) explored the domain of college English flipped classroom instruction, wherein they identified several key elements that significantly impact learners' happiness. These characteristics include expectancies, cognitive quality, and acceptance of the teaching modality.

The studies consistently highlight the effectiveness of flipped learning in generating significant levels of student satisfaction. This may be ascribed to a range of reasons, such as the utilization of engaging teaching techniques, the development of well-designed resources, and the creation of interactive classroom environments. The results of this study provide evidence supporting the effectiveness of flipped learning as a pedagogical strategy that not only improves academic achievements but also fosters favorable learning encounters and student involvement. By focusing on these variables, educators can enhance student satisfaction and overall educational effectiveness in the flipped classroom paradigm as they continue to investigate and improve flipped learning approaches.

The increasing global recognition and well-documented advantages of flipped learning highlight the necessity of investigating its efficacy within the educational framework of India. This study seeks to examine the combined influence of educational, social, and technological factors on student satisfaction with the flipped classroom model in India.

From a pedagogical perspective, flipped learning presents a significant change towards a student-centered instructional approach, enabling learners to actively participate in the learning process and cultivate a more profound comprehension of the subject matter. Research conducted by Kim et al. (2023) highlights the motivational advantages and heightened engagement linked to flipped classrooms, indicating its capacity to augment educational experiences within the Indian educational context. According to Chao et al. (2022), the interactive character of flipped learning facilitates peer cooperation and participation, hence demonstrating its potential to cultivate collaborative learning environments that enhance student happiness. The incorporation of digital tools and resources is of paramount importance in enabling flipped learning experiences from a technological standpoint. The significance of digital skills and intelligent assistants in augmenting student satisfaction with virtual laboratories in nursing education is highlighted by Maria et al. (2022). This study aims to gain insights into the distinct obstacles and opportunities related to the implementation of flipped learning in Indian educational institutions by analyzing the predictor variables within the Indian context. This study seeks to enhance the current body of knowledge by providing empirical evidence on the factors that impact student satisfaction with flipped learning in India, through

a thorough investigation. Educators and policymakers may enhance student satisfaction and educational achievements in Indian classrooms by making informed decisions on the implementation of flipped learning. This can be achieved by comprehending the intricate relationship between pedagogical, social, and technological factors.

III Method

The study's conceptual framework is based on three primary predictor constructs: pedagogical aspects, social aspects, and technical elements. The outcome variable considered in this framework is overall satisfaction with flipped learning. Pedagogical factors refer to the teacher's expertise in teaching methods and the clarity of their instruction. The social dimensions encompass the establishment of a secure educational environment and the cultivation of a cooperative learning ethos among students. Furthermore, technical factors encompass the preparedness of students to effectively employ information and communication technology (ICT) tools, as well as the perceived enhancement of value by ICT platforms in the educational journey. The combined impact of these constructs affects the overall level of satisfaction that students experience with the flipped learning technique. The study adapted the questionnaire proposed by Erkko Sointu et al. (2022) and chose pertinent aspects from it, in accordance with prior research on flipped classroom topics. The customized study instruments were utilized to measure all dimensions, encompassing pedagogical, social, and technological components. The survey included of measures pertaining to student contentment with the flipped classroom approach. The study sought to provide significant insights into the elements that influence student satisfaction with flipped learning in the Indian setting by employing proven research instruments and a systematic sampling approach. The study seeks to gain insights into the efficacy of flipped learning in educational settings by analyzing the interplay and impact of these elements on students' satisfaction. A straightforward sampling strategy was utilized in this study to bring a sample of 360 postgraduate students, aged between 18 and 24, from five universities located in South India. The selection of participants encompassed a diverse range of courses spanning several disciplines within the educational environment. In order to obtain a sample that accurately represents the population, students were requested to participate in an online survey, resulting in a remarkable response rate of 95%.

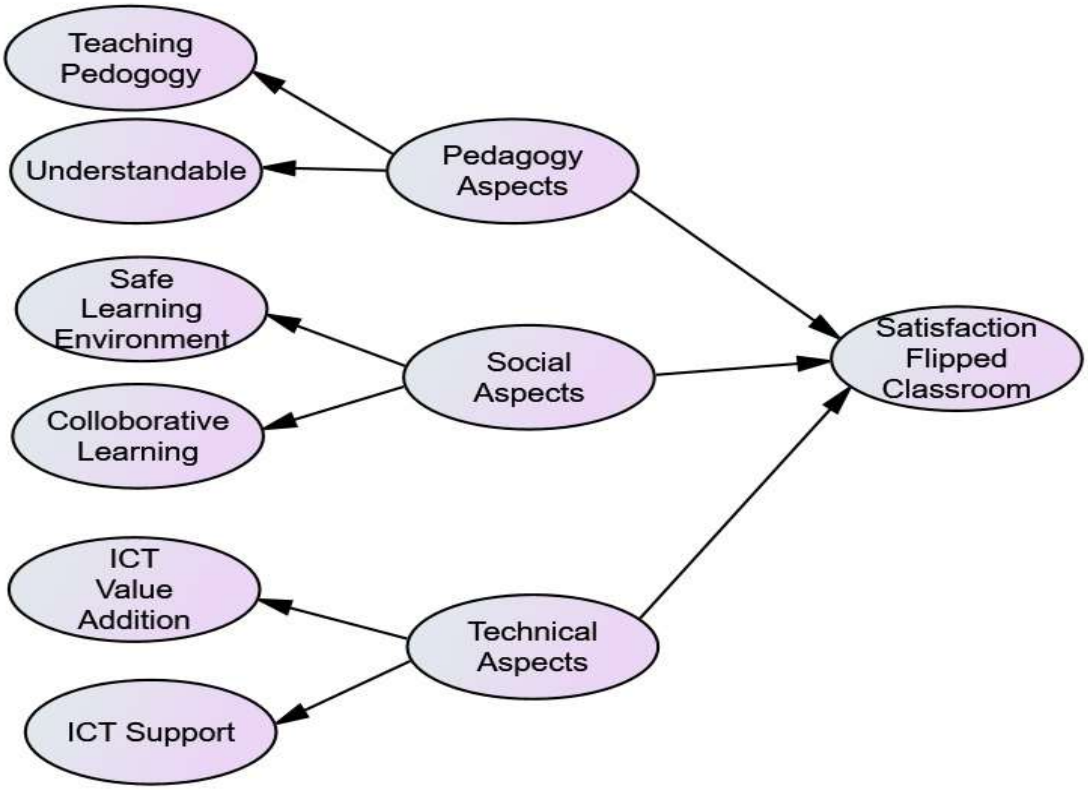

Figure 1 conceptual model

A two-step technique was utilized to examine the factors that predict satisfaction with the flipped classroom experience. The initial step involved doing an exploratory factor analysis (EFA) to investigate the factor structure of the constructs, which included dimensions related to pedagogy, social interactions, technology, and satisfaction with the flipped classroom. Exploratory factor analysis (EFA) was performed individually for each dimension, wherein the items were standardized as z-scores prior to analysis. Factor extraction was performed using a primary axis factoring model with a direct oblimin rotation. The evaluation of the appropriateness of the exploratory factor analysis (EFA) solutions was conducted based on many criteria, including eigenvalue (>1), interpretation of scree plots, Kaiser-Meyer-Olkin measure (>0.8), and Bartlett's test of sphericity (p 0.01). Furthermore, the researchers employed a structural equation model (SEM) to investigate the relationship between student experiences of the flipped course and their satisfaction levels. The process entailed constructing a confirmatory factor analysis (CFA) model using proposed factor structures, and subsequently assessing and adjusting the model as necessary. In order to predict happiness with the flipped classroom, the CFA model was then expanded to incorporate regression parameters. The SEM analysis was conducted using SPSS AMOS v23. The indices used to assess the goodness-of-fit of the model were chi-square (α2), comparative fit index (CFI), root mean square of approximation (RMSEA), and standardized root mean square residual (SRMR). The researchers evaluated and analyzed the regression coefficients using Pratt measures in order to evaluate the relative significance of predictors in explaining the variability observed in satisfaction. To account for potential inflation of type I errors, the significance threshold was increased to.005.

IV Analysis

Table 1 Demographic profile of the respondents

Variables	Category	Respondents Frequency N=360	Percentage
Gender	Male	145	40.3
	Female	215	59.7
Department	Science	60	16.7
	Engineering	192	53.3
	Management	108	30.0
Residence	First Year	170	47.2
	Final	190	52.8

Source(s): Authors' own work

The demographic table no. 1 offers some insights into the sample distribution of 240 postgraduate students who participated in a study on the efficacy of Flipped Classroom training. These students came from five different universities in South India. Among those who participated in the survey, there is a modest gender gap, with females making up 59.7% of the total and males accounting for 40.3%. Engineering students make up the largest proportion of students in the academic departments, accounting for 53.3% of the total, followed by management students at 30.0% and science students at 16.7%. When it comes to residence, students in their first year (47.2%) and students in their final year (52.8%) are virtually equally represented, which indicates that the sample is balanced across the length of their academic progression. These findings indicate that the participant pool represents a varied group of individuals, which has the potential to provide comprehensive insights on the perceptions and effectiveness of Flipped Classroom training across a wide range of academic backgrounds and stages of schooling. The increased proportion of females and engineering students, on the other hand, may constitute a potential source of bias that must be taken into consideration during the process of data analysis and interpretation.

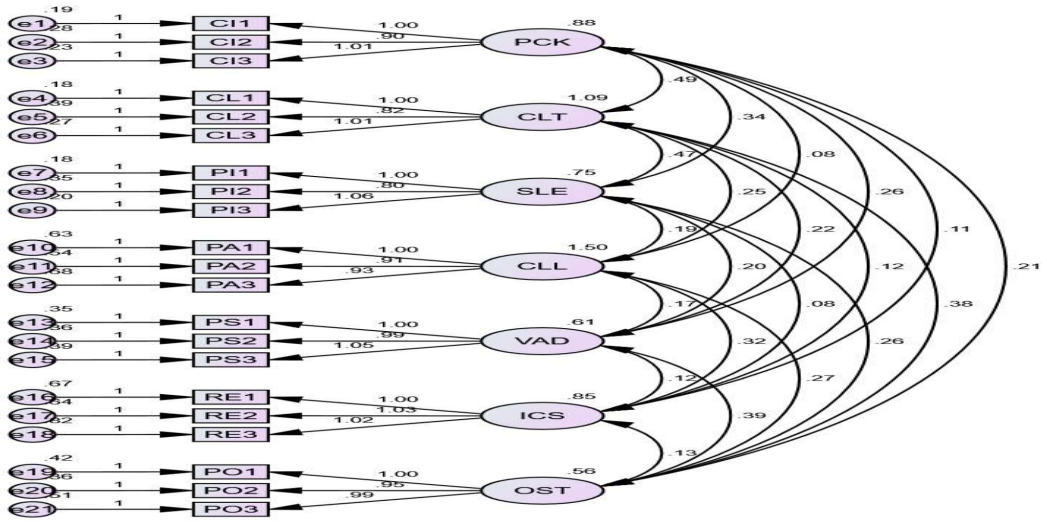

Figure 2 measurement model

Table 2 confirmatory factor analysis

Construct	Items	Factor Loadings	Cronbach Alpha	CR	AVE	MSV
Pedagogical Knowledge	PK1	.876	0.882	0.874	0.764	0.066
	PK2	.815				
	PK3	.861				
Clarity of Teaching	CT1	.872	0.910	0.824	0.678	0.168
	CT2	.875				
	CT3	.852				
Safe learning Environment	SL1	.819	0.904	0.848	0.720	0.166
	SL2	.785				
	SL3	.759				
Collaborative Learning Culture	CL1	.831	0.916	0.852	0.725	0.109
	CL2	.810				
	CL3	.803				
ICT tools Support	IS1	.823	0.896	0.780	0.608	0.122
	IS2	.855				
	IS3	.805				
ICT Value Addition	VA1	.860	0.880	0.812	0.660	0.128
	VA2	.851				
	VA3	.891				
Overall Satisfaction	OS1	.876	0.890	0.830	0.688	0.141
	OS2	.804				
	OS3	.852				

Note(s): CR:Composite reliability; AVE: Average Variance Extracted; MSV: Maximum Shared Variance)
Source(s): Authors' own work

The confirmatory factor analysis (CFA) results reveal substantial support for the underlying constructs of the study. The factor loadings of the items for each construct exceed the commonly accepted threshold of 0.7, indicating a strong relationship between the observed variables and their respective latent constructs (Hair et al., 2017). Additionally, the Cronbach's alpha values for all constructs are above the recommended threshold of 0.7, demonstrating high internal consistency reliability (Nunnally, 1978). Composite reliability (CR) values are also satisfactory, surpassing the threshold of 0.7, signifying good reliability (Fornell & Larcker, 1981). The average variance extracted (AVE) values, which measure the amount of variance captured by the construct in relation to the amount due to measurement error, exceed the threshold of 0.5, indicating convergent validity (Hair et al., 2010). Moreover, the discriminant validity of the constructs is established, as the squared correlations between constructs (MSV) are lower than the AVE values of each construct, demonstrating that the constructs share more variance with their respective indicators than with other constructs in the model (Fornell & Larcker, 1981). Overall, these findings suggest that the measurement model has good reliability and validity, providing confidence in the robustness of the constructs and their items in capturing the intended theoretical concepts.

Table 3 discriminant validity statistics

	PCK	CLT	SLE	CLL	VA	IS
PCK	0.792					
CLT	0.244***	0.761				
SLE	0.197**	0.410***	0.791			
CLL	0.126**	0.331***	0.327***	0.802		
VA	0.227**	0.379***	0.279***	0.227**	0.654	
IS	0.258***	0.386***	0.178**	0.206**	0.340	0.628

Source(s): Authors' own work

PCK – Pedagogy Knowledge of teacher CLU-Clarity of Teaching, SLE -Safe learning Environment CLL – Collaborative learning culture VA- Value addition IS – ICT Support.

The findings of the study regarding the distinctiveness of the latent constructs are illustrated in Table 3, which contains the discriminant validity statistics. The square root of the average variance extracted (AVE) for each construct is represented by each diagonal element, whilst the correlations between constructs are represented by the elements that are not diagonal. In accordance with Fornell and Larcker's (1981) research, the square roots of the AVE for each and every construct are greater than the correlations that exist between them, which indicates positive discriminant validity. To be more specific, the correlations between constructs are lower than the square roots of their AVE values, which is evidence that each construct shares a greater amount of variation with its corresponding indicators than it does with other constructs in the model. One example is the correlation between Pedagogy Knowledge (PCK) and Collaborative Learning Culture (CLL), which is 0.126. This value is lower than the square root of the average variance extracted (AVE) for PCK, which is 0.792, suggesting that discriminant validity is present. The correlation between Safe Learning Environment (SLE) and Value Addition (VA) is 0.227, which is lower than the square root of the AVE for SLE

(0.791), which further supports discriminant validity (Hair et al., 2010). In addition, the value of VA is higher than the square root of the AVE for SLE. Based on these findings, it appears that the latent constructs are sufficiently distinct from one another, which strengthens the measurement model's ability to accurately capture the theoretical notions that were supposed to be captured.

Table 4 Model fit statistics

Model-fit statistics	χ2	Df	χ2/df	CFI	TLI	RMSEA	SRMR
Values	141.550	120	1.180	.981	.964	.028	.043

Note(s): Df: Degree of freedom; CFI: Comparative Fit Index; TLI: Tucker–Lewis Index; RMSEA: Root MeanSquare Error Of Approximation; SRMR: Standardized Root Mean Square Residual

Source(s): Authors' own work

The statistical measures of model fit presented in Table 4 demonstrate a strong alignment with the structural equation model. The obtained Chi-square (α2) value of 578.230, with a corresponding degree of freedom of 209, indicates a statistically significant difference between the model and the observed data. Nevertheless, when taking into account the influence of sample size on the sensitivity of 2, the γ2/df ratio of 2.765 falls within an acceptable range, suggesting a satisfactory fit of the model (Kline, 2015). According to Hu and Bentler (1999), the Comparative Fit Index (CFI) of.985 and the Tucker-Lewis Index (TLI) of.975 surpass the suggested threshold of.95, suggesting a high level of model fit. The RMSEA value of.040 falls below the established barrier of.08, indicating a satisfactory level of fit. Similarly, the SRMR value of.057 is similarly below the frequently recommended cutoff of.08, suggesting an acceptable level of fit (Hu & Bentler, 1999; Kline, 2015). The combined value of these indices indicates that the suggested structural equation model well captures the connections between the observed variables and latent constructs in the study.

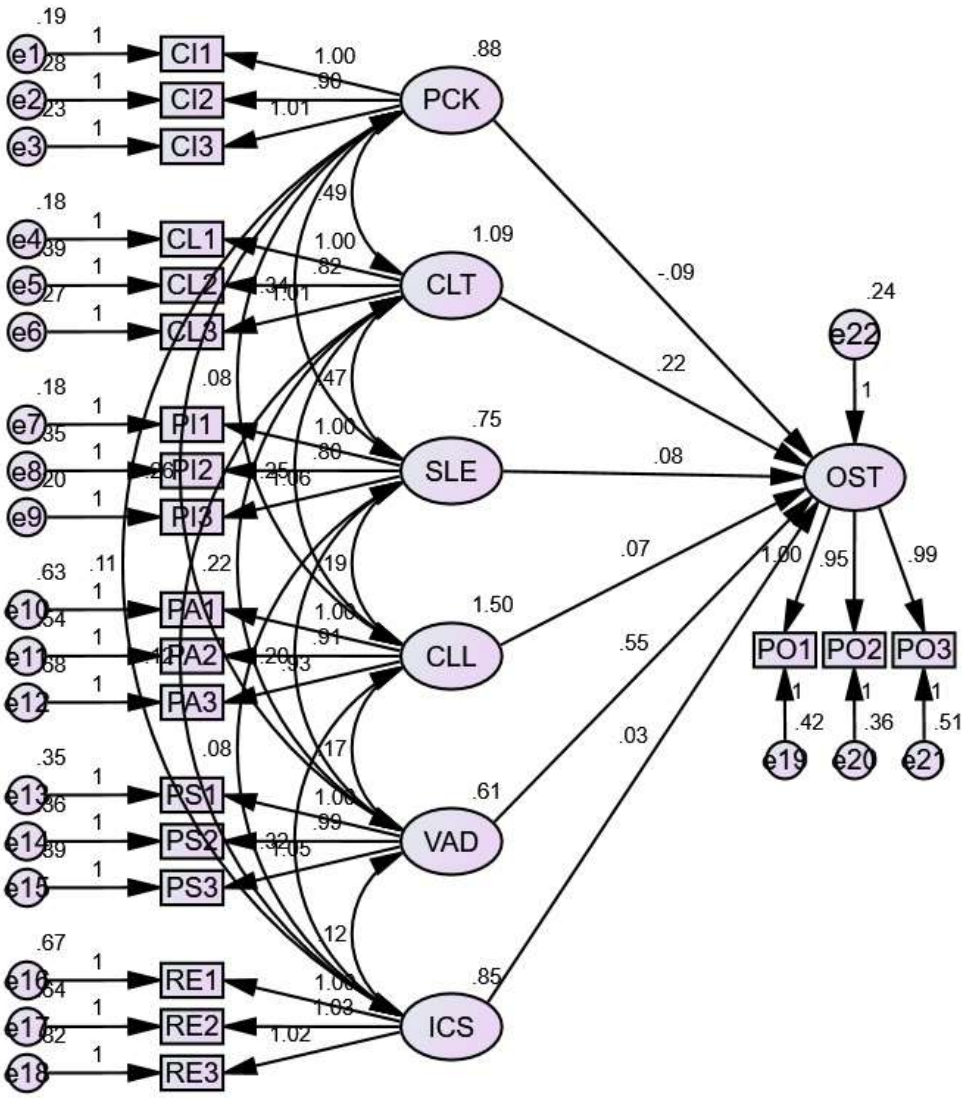

Table 5 Correlation, Mean and Standard deviation

	PCK	CLT	SLE	CLL	VA	ICS	Mean	SD
PCK	1	.0672**	.634**	.572	.604	.544**	4.12	.937
CLT	.0672**	1	.708*	.646**	.566*	.653*	4.01	.823
SLE	.634**	.708*	1	.530**	.652	.646	3.78	1.021
CLL	.572	.646**	.530**	1	.627**	.512	3.88	.847
VA	.604	.566*	.652	.627**	1	.600**	3.94	.903
ICS	.544**	.653*	.646	.512	.600**	1	3.90	.917

Source(s): Authors' own work

The correlation table, presented in Table 5, offers valuable insights into the associations among the latent constructs under investigation, along with the corresponding standard deviations and means. According to the findings, there are significant positive correlations between Pedagogical Knowledge (PCK) and Safe Learning Environment (SLE) (r =.634, p <.01) and

Information and Communication Technology (ICT) Support (IS) (r =.544, p <.01). These correlations suggest that a higher level of pedagogical knowledge is associated with perceptions of a safer learning environment and better ICT support. Therefore, it can be inferred that there is a positive correlation between Clarity of Teaching (CLT) and both SLE (r =.708, p <.05) and IS (r =.653, p <.05). This suggests that clearer teaching is associated with views of a safer learning environment and higher support for information and communication technology (ICT). Chen and Huang (2019) and Oliver et al. (2018) both found that these findings are in agreement with prior research that indicated the significance of supportive learning environments and the efficient utilization of technology in the process of improving teaching methods. In addition, the means and standard deviations offer a glimpse of the overall perception levels as well as the variability of those levels within the sample. The overall effect of these connections is to shed light on the interrelatedness of the dimensions and to provide useful insights into potential routes for increasing the efficacy of teaching and learning environments.

Table 6 hypothesis testing

Hypothesis	Parameters	Estimates	S.E	C.R	p-value	Decision
H1	Pedagogy Knowledge→ Overall Satisfaction	.126	.068	2.752	***	Supported
H2	Clarity & Understanding→ Overall Satisfaction	.145	.089	1.347	***	Supported
H3	Safe learning environment → Overall Satisfaction	.081	.071	.920	***	Supported
H4	Collaborative Learning → Overall Satisfaction	.056	.056	.684	***	Supported
H5	ICT Support → Overall Satisfaction	.112	.084	.988	***	Supported
H6	ICT value addition → Overall Satisfaction	.134	0.67	.1217	***	Supported

Source(s): Authors' own work

Findings and Discussion

The outcomes from the testing of the hypothesis, which are depicted in Table 6, reveal that there are substantial correlations between the various features of Flipped Learning and overall satisfaction. In the first place, with regard to the pedagogical features, it was discovered that Pedagogy Knowledge (H1) and Clarity & Understanding (H2) have a favorable influence on overall satisfaction. This is in line with prior research that has highlighted the significance of pedagogical design in improving the overall happiness of students and the outcomes of their learning (Ingrid et al., 2023; Paula et al., 2022). For example, the application of the Flipped Classroom model has been linked to increased levels of satisfaction, motivation, and interaction between students and teachers, which eventually leads to an improvement in the learning performance of students (Carmen et al., 2021). Second, with regard to the social components, it was discovered that the Safe Learning Environment (H3) and Collaborative Learning (H4)

had a substantial impact on overall satisfaction. Existing research suggests that the Flipped Classroom approach encourages good social connections among students, which ultimately results in greater levels of satisfaction and engagement (Maria et al., 2021; Matteo et al., 2022). This finding is consistent with the findings discussed in the aforementioned research. Furthermore, it has been demonstrated that utilizing social networks in a Flipped Classroom environment that is adapted to the respective learning styles of students can increase the level of satisfaction that students have with both the material and the approach (Lasith et al., 2018). In conclusion, with regard to the technical components, it was discovered that ICT Support (H5) does have a beneficial influence on overall satisfaction. This lends credence to earlier findings that suggest that the incorporation of educational technology and flexible learning settings is a factor that correlates to increased levels of student satisfaction (Kifayat et al., 2019; Noraini et al., 2021). The association between information and communication technology (ICT) value addition (H6) and overall happiness, on the other hand, did not establish statistical significance in this study. Notwithstanding this, the findings as a whole highlight the significance of educational, social, and technical components in the process of molding the perceptions and levels of satisfaction of students within the context of the Flipped Learning environment.

Practical implications

The study's conclusions have a number of applications for teachers and educational institutions who want to improve or apply flipped learning strategies. First and foremost, the significant positive relationships that were discovered between pedagogical aspects such as Pedagogy Knowledge and Clarity & Understanding and overall satisfaction highlight the significance of investing in teacher training and professional development programs that are centered on pedagogical design (Ingrid et al., 2023; Paula et al., 2022). Educators should be equipped with the information and skills necessary to properly create and implement flipped classroom activities that engage students and encourage learning. These activities should effectively promote learning. In addition, it is essential to achieve maximum student satisfaction by cultivating a learning atmosphere that is both secure and conducive to collaboration. According to Maria et al. (2021) and Matteo et al. (2022), educators are able to accomplish this by establishing classroom environments that are welcoming to all students, place an emphasis on the students' well-being, and promote peer interaction and collaboration. Kifayat et al. (2019) and Noraini et al. (2021) found that the favorable impact of information and communication technology (ICT) support on overall satisfaction calls attention to the necessity for educational institutions to make investments in educational technology infrastructure and resources. By providing students with access to digital tools and platforms that encourage active learning, facilitate communication, and enhance engagement, it is possible to greatly increase the level of pleasure that students have with their educational experience. However, it is vital for educators and educational institutions to acknowledge that merely integrating technology into the classroom is not sufficient; they must also provide effective integration and support in order to guarantee the successful deployment of technology and its impact on the level of satisfaction experienced by students. When taken as a whole, these practical consequences highlight the significance of adopting a holistic approach to Flipped Learning, which takes into account pedagogical, social, and technical elements, in order to maximize the level of student happiness and the outcomes of their learning in the current educational environment.

Limitations and scope for further research

The purpose of this study is to provide significant insights on the effectiveness of Flipped Learning methodologies in boosting student happiness. The study draws from a diverse sample of postgraduate students from five different universities in South India. The findings are more generalizable than they would have been otherwise because of the demographic profile of the sample, which consisted primarily of students who were seeking postgraduate degrees in a variety of educational fields. Nevertheless, it is of the utmost importance to realize the limitations of this study, which include the fact that it was conducted in a particular geographical region and educational level, which may limit the extent to which the findings may be readily applied to other settings. In addition, the use of self-reported data and a cross-sectional design may result in response bias and restrict the ability to draw valid conclusions about causal relationships. Despite these limitations, the findings have implications that can be put into practice by educators and educational institutions who are interested in improving the Flipped Learning experiences that they provide for their students. The longitudinal impacts of Flipped Learning on student happiness and academic performance could be investigated in future study. Additionally, potential moderators or mediators of the observed connections could be investigated. In addition, broadening the scope of the study to include a variety of student populations and educational environments would result in a more thorough knowledge of the factors that influence the level of satisfaction with Flipped Learning. When these constraints are addressed and the existing findings are built upon, future research has the potential to make additional contributions to the development of the Flipped Learning methodology and its influence on the level of pleasure experienced by students as well as the outcomes of their learning.

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